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THE OLECRANON PERFORATION.

BY DR. D. S. LAMB.

In a collection of sixty-nine skeletons and parts of skeletons of prehistoric Arizona Indians from the valley of the Salado I found that 54 per cent. of the eighty-nine humeri showed the olecranon perforation; forty-three of the right side, with nineteen foramina, or 44 per cent., and forty-six of the left side, with twenty-nine foramina, or 63 per cent.

In another collection from ruins of the ancient Seven Cities of Cibola, near Zuni, New Mexico, were sixty-one humeri, with twelve foramina, or 20 per cent.; thirty right humeri showed two foramina, or 7 per cent.; thirty-one left, ten foramina, or 32 per cent.

In a third collection of Indian bones from mounds in different parts of the United States, including New York, Maryland, Illinois, Wisconsin, and Dakota, there are sixty-two humeri, with seventeen foramina, or 20 per cent.; thirty-five right, with seven foramina, or 20 per cent., and twenty-seven left, with ten foramina, or 37 per cent.

The Army Medical Museum also contains forty-eight skeletons from nineteen of the existing tribes of Indians. Of these ninety-six humeri the foramen is present in but five, or 5 per cent., a remarkable contrast with the prehistoric races. One of these skeletons showing the foramen is of a Sioux only about twenty years old.

There are eight skeletons of negroes and mulattoes with but one olecranon foramen, or 6 per cent. Standing alone, this would seem to favor the statement of Pruner-Bey and others that the foramen is not present in the negro race. There is a skeleton of a Chinese woman showing the foramen present on both sides, and one of a Frenchman showing it on one side.

In the pathological series of the Museum are 298 humeri, with twenty-two foramina, or 7.5 per cent. Of these humeri 160 are of the right side, with six foramina, or nearly 4 per cent., and 138 left, with sixteen foramina, or nearly 12 per cent. These bones are nearly all from soldiers in the military service, and principally white, thus disposing of the suggestion that the foramina are found only in the female sex. One of the injured bones is from a Mexican boy.

With few exceptions the skeletons in the Museum are either infantile or adult. It is the more interesting, therefore, to know that of the adolescents two show the foramen.

In my own private collection of humeri, twenty in number, there are six foramina, or 30 per cent.; eleven are of the right side, with two foramina, or 18 per cent., and nine of the left, with four foramina, or 44 per cent. These humeri were obtained from cadavers used in dissection, and as most cadavers in this locality are of negroes or mulattoes it is reasonable to suppose that most of these humeri are from the negro race.

A review of the humeri in the above collections shows that the foramen was found in the proportion of 13 on the right side to 27.5 on the left, or more than twice as often on the left side.

The examination covered nearly 650 humeri and seemed to establish—

1st. The greater frequency of the foramen in the ancient peoples.

2d. Its greater frequency on the left side.

3d. Its occurence in adolescents, as well as mature individuals, in both sexes, and not confined to any one race.

The most important question which arises is as to the use and significance of the foramen. It is obvious that the more the coronoid or olecranon fossæ are deepened the thinner becomes the partition, and a step further produces a perforation. This deepening and perforation increase the extent of flexion and extension of the forearm. What was there in the habits of the prehistoric and ancient peoples which needed this increased flexion or extension and resulted in the foramen? and why should this be more frequent on one side, and that side the left?

To arrive at a solution of these questions it seemed necessary first to ascertain in regard to its presence in the lower animals and compare the results with their habits.

I accordingly examined the specimens displayed in the United States National and Army Medical Museums. Some perforations appear to have occurred in the preparation of the specimens, and these I did not count. There was seldom any difficulty in distinguishing the true foramen, which always has a smoothly rounded, usually oval, margin; no such opening could be produced by accident. Species are illustrated in museums by single specimens; occasionally by two or more. The presence or absence of the foramen in any one specimen cannot be taken as an index for the species, since it may be simply an individual variation; but where specimens of several species of the same genus show it, we are justified in assuming its common occurrence in those species, if not in the genus.

When the foramen is large, especially when the animal is young or small, I think we have a more certain indication of its common occurrence in that species than where the opening is small and therefore more possibly a variation. I believe that the foramen is formed in the latter part of the period of development of the individual; it is much more rarely found in the early part, although I cannot be so certain of this, because the museums contain but few skeletons of the earlier periods.

The foramen has not been seen in any but the Mammalia.

The testimony for the anthropoid apes is as follows: Several authors (29, 42, 49) have noted it in the chimpanzee. Hartmann, however, found it but once in four cases, and then on the left side. I have seen one specimen. It has been seen in the gorilla (47, 48, 49). In Kneeland's case it was only on the right side. Hartmann found it twice in four individuals. I have seen two specimens, one an old female with the openings, the other an old male without them. Hartmann failed to find it in the orang-utan, and Desmoulins says it does not occur. I have seen three specimens, in two of which it was present and the openings were large. Mivart says it is sometimes present in the gibbons (*Hylobates*); Desmoulins that it is not found in *H. syndactylus.* It was absent from two specimens, a *H. lar* and *H. leuciscus,* which I have examined.

The old-world monkeys include more than a hundred species. The testimony for the *Colobinæ* is negative. Meckel says it is present in the *Cercopithecinæ*; Mivart that it is found sometimes in the green monkey. I have seen it in this and also a vervet, but only on the right side. Meckel says it is present in the white-crowned mangabey; it was absent from the sooty mangabey. Mivart says it is sometimes present in the genus *Macacus.* I have seen it in the toque monkey. It was absent from the bonnet monkey and black ape. The best testimony is for the dogheaded baboons. Meckel found it in the Arabian baboon. I have seen it in the anubis and in one of two chacmas. Meckel says it is present in the mandrill, and I have seen it in three specimens, one a young animal, and both the foramina large.

Of over a hundred species of new-world monkeys and marmosets I have seen thirteen specimens representing nine species, and did not find any foramina; neither do authors mention their presence.

It was absent from two specimens of *Indris*, from the ruffed and slow lemur. Blainville and Mivart found it in the slender lemur, and I have seen two specimens which showed it; in one the openings were very large. Mivart says it is sometimes present in the awantibo.

Passing to the Carnivora, Blainville says it is not present in the cats, about sixty-six species, except the pampas cat of South America. I have seen it in one ocelot on both sides, but in specimens representing eight other species it was absent. Blainville mentions its presence and I have seen it in some of the civets. A specimen of the aard-wolf showed it. Meckel and Arens say it is present in the hyenas, including the fossils. Blainville found it in the striped hyena, and I have also seen it. Filhol shows it in *Hyænodon*.

Blainville, Meckel, and Arens all speak of its constancy in the dog. All the species I have seen showed it, the only exceptions being an Eskimo-dog and a *Dachshund.*

Of seventeen out of nearly a hundred species of weasels the foramen was found, so far as I know, only in four—tayra, *Mellivora Capensis*, *Mydaus*, and American badger. It does not appear to have been seen in the raccoons or bears, nor in any of the aquatic Carnivora.

The Ungulata.—It is absent from the ox, sheep, goat, giraffe, and camel, and from the deer, except perhaps the roe, in which Arens has seen it; but the specimen I have seen did not show the foramen. I have found it in a specimen of the Javan chevrotain, but absent from two others. Generally speaking, therefore, we may say that it is absent from the deer. The prong-horned antelope affords a striking contrast. I found the opening in four out of five specimens. Out of over 200 species, therefore, of the section Pecora the foramen may be said to be present in but one.

In contrast with the Pecora the foramen is generally present in the Suina. All of seven specimens of the collared peccary showed it; one was a young animal; another had just matured. Arens says that the foramen is present in the whole family. Blainville found it in the wild hog and babiroussa, and Meckel in the common hog. Arens discredits the latter, and of about a dozen specimens which I have seen it was absent from all; most of these, however, were young. It may be that domestication has changed the habits of the hog. The opening has been seen in Pallas's wart-hog and the Liberian hippopotamus.

The Perrissodactyla afford some striking contrasts. The horse, rhinoceros, and elephant do not show it. It has been seen by Blainville in the daman. Blainville, Meckel, and Arens all found it in the American tapir. Of the six species I have seen four, the American, Malay, white-lipped, and Baird's tapir. Of eight specimens of the latter, sixteen humeri, there were three foramina on the right side, six on the left. Three of the specimens were young animals, in two of which the opening was absent; in one, absent on the left side.

Blainville and Cope mention its presence in some of the fossil Ungulata.

The Sirenia and Cetacea do not show it.

Out of more than 700 species of rodents the foramen was found in four of the squirrels; eighteen other species representing seven genera did not show it. It is absent from the beavers and gophers. It has been seen in three out of about 330 species of rats. The common rat and mouse do not show it. It has been seen in some of the octodons; in some of the agoutis, spotted cavy, guinea pig, and capybara. The large size of the opening in the Javan porcupine, golden agouti, guinea pig, and capybara is worthy of mention. All of the hares show the foramen.

It is probably constant in some of the Insectivora, as the tenrec and common hedgehog; I have also seen it in *Solenodon cubanus* and the South African hedgehog. Blainville found it in the *Tupaiidæ* and he and Meckel in the flying lemurs. It was absent from the moles and shrews.

It is also absent from the bats and endentates, and probably the marsupials.

The olecranon perforation in the lower animals.

Chimpanzee, frequent.
Gorilla, frequent.
Orang-utan, frequent.
Gibbon, rare.

Colobinæ, absent.
Cercopithecinæ, occasional.
Mandrill, constant.

New-world monkeys, absent.

Slender lemur, constant.

Cats, absent.
Civets, common.
Hyenas, constant.
Dogs, constant.
Weasels, occasional.
Raccoons, absent.
Bears, absent.
Aquatic carnivora, absent.

Ox, absent.
Sheep, absent.
Goat, absent.
Giraffe, absent.
Camel, absent,
Deer, absent.
Prong-horned antelope, constant.

Peccary, constant.
Wild hog, present.
Domestic hog, absent.
Hippopotamus, present.

Horse, absent.
Rhinoceros, absent.
Elephant, absent.
Tapir, nearly constant.
Fossil Ungulata, sometimes.

Sirenia, absent.

Cetacea, absent.

Squirrels, rare.
Beavers, absent.
Gophers, absent.
Rats, rare.
Octodons, common in some.
Hares, constant.

Tenrec, constant.
Hedgehog, constant.
Moles, absent.
Shrews, absent.

Bats, absent.

Edentates, absent.

Marsupials, absent.

Monotremes, absent.

Several authors (1, 16, 27, and 28) have mentioned the occurrence of the opening in the lower animals. Mivart (42), p. 310, says: "The coronoid fossa is generally shallower in the Lemuroidea than in the Anthropoidea. A perforation extends into the olecranal fossa in some. This is very large and constant in *Loris*, but it is also present in *Troglodytes* and *Simia*, and sometimes in *Hylobates*, man, *Cercopithecus*, *Macacus*, and *Arctocebus*. The olecranal fossa is sometimes deep, as in the *Simiidæ*, especially the *Cynopithecinæ*. It is less so in man, and still less so in the lemuroids, especially in *Indris*."

Many works on human anatomy mention its occurrence in the human subject. (See 1 to 19, 22 to 27, and 42.) Meckel, 1825 (28), says that it is sometimes found in man, but is small; that the inferior races show it perhaps oftener than the superior. He found it especially in negroes and Papuans. Desmoulins, 1826 (29), mentions a Hottentot skeleton which showed the foramen, and refers to its being found in the Bushmen and Guanches, and states that in this respect they differ from the Mongols. He was in error as to the latter.

Dr. Jeffries Wyman (30), in 1853, examined at the *Jardin des Plantes*, Paris, the skeletons of seven full-blooded negroes; seven of the fourteen humeri, or 50 per cent., showed the foramen; in three subjects it existed on both sides; in one, only on one side.

In 1862 the Boston Society for Med. Improvement discussed the subject (30), and specimens from Indian mounds were shown. In 1863 the Anthropological Society of Paris took it up (31 to 37). Broca inaugurated the discussion, which recurred at intervals till 1881. Broca, Pruner-Bey, and Lagneau were the most prominent speakers. Perforated bones were shown from different parts of Europe: as the caverns of Montmaigre; sepulchre of Chelles; excavations of Chamont (stone age) and St. Etienne; Furfoz (reindeer age); caverns of Ariége; a Parisian cemetery of the XVIIth century; cavern of Frontal, Belgium; from the Ardéche; Vaureal, and Charreouy (polished stone). Pruner-Bey believed that the foramen was found only in women, because all the perforated humeri that he saw were small.

Verneau, 1878 (36), stated, in regard to the Guanches of the Canary Islands, that the humeri were robust, twisted, and often perforated; that the frequency of the foramen surpassed any previously known. In one grotto he found sixty-nine perforated humeri out of 150, or 46 per cent.; in other grottoes, a less per cent., but still high; and sometimes the foramen was of uncommon size. He did not find the anomaly among the present people of the islands.

Thulié, 1881 (37), stated that in the Bochimans the humeri were small and slender and the olecranon cavity perforated like the Guanches, some Egyptians, and many prehistoric humeri.

The subject was also discussed by the International Congress of Anthropologists, Paris, 1867 (38). Broca claimed that it had no connection with the rank a people held in the scale of races, and that the foramen constantly became rarer since prehistoric times. During the discussion it was stated that the opening had been seen in the humeri of natives of Peru, Bolivia, and Mexico, and also in the Kalmucs.

The following is a list of collections, numbering sixteen humeri and upwards and arranged in the order of highest percentage of foramina:

No. of humeri.	No. of foramina.	Per cent.	Authority.	
89	48	54	A. M. M. col.	Prehistoric Arizona Indians.
150	69	46	Bull. Anthrop. Soc.	Guanches, Canary islands. (Verneau.)
30	------	36.2	Topinard	Yellow and American races.
32	------	34.3	"	Polynesians.
80	------	31.2	"	Indian mounds of U. S. Wyman, Peabody Museum.
20	6	30	The author	Private collection, mainly negro and mulatto.
62	17	28	A. M. M. col.	Indian mounds, U. S.
67	18	28	Pruner-Bey	From Vaureal, France.
122	------	25.6	Topinard	Guanches of Canary islands.
156	------	21.8	"	Dolmens and grottoes around Paris. Polished stone.
97	------	21.7	"	African negroes.
61	12	20	A. M. M. col.	Prehistoric Indians, ancient cities New Mexico.
28	------	14.1	Topinard	Melanesians.
30	------	12.1	"	Dolmens. De Quiberon.
66	------	10.6	"	Caverns of l'homme mort, Lozere. Polished stone.
388	------	10.6	"	Dolmens, Lozere. Polished stone.
288	22	7.5	A. M. M. col.	Mostly white soldiers.
27	2	7	Anthrop. Soc., Paris	Bulletins. From Chamont, stone age.
16	1	6	A. M. M. col.	Negroes and mulattoes.
200	------	5.5	Topinard	Parisians from IVth to XIIth centuries.
96	5	5	A. M. M. col.	Cotemporary Indians.
150	------	4.6	Topinard	Parisians of Cemetery of Innocents. (Hamy and Sauvages.)
*218	------	4.1	"	Parisians of Middle Ages. (Broca and Bataillard.)
52	------	3.8	"	Europeans of America. Wyman, Peabody Museum.
*218	7	3.2	Bull. Anthrop. Soc., Paris.	Paris cemetery of XVIIth century. Broca.
30	0	0	Topinard	Long barrows of England, bronze age.

* Probably same collection.

Dr. Wyman, in the Peabody reports of 1868–'78 (39), states that out of eighty humeri from the mounds of the western states and Florida twenty-five, or 31 per cent., were perforated; fifty-two humeri of Europeans examined by comparison gave only two cases, or 3.9 per cent.

Dr. Montané, 1876 (40), presented six specimens of the foramen found in the island of Cuba to the Havana Academy, and said they were of the Chinese race.

To sum up the foregoing: Meckel mentions its frequency in the Papuan; Meckel and Wyman in the negro, and I am inclined to agree with them, although Broca, Lagreay, and Pruner-Bey doubt it; Broca, Pruner-Bey, and Desmoulins in the Hottentot; Desmoulins and Thulié in the Bushmen; Pruner-Bey and Thulié, its occurrence in the Egyptians; Broca, Desmoulins, Lagneau, Thulié, and Pruner-Bey all put the proportion high in the Guanches, and Verneau says it is not found in the present race of the islands.

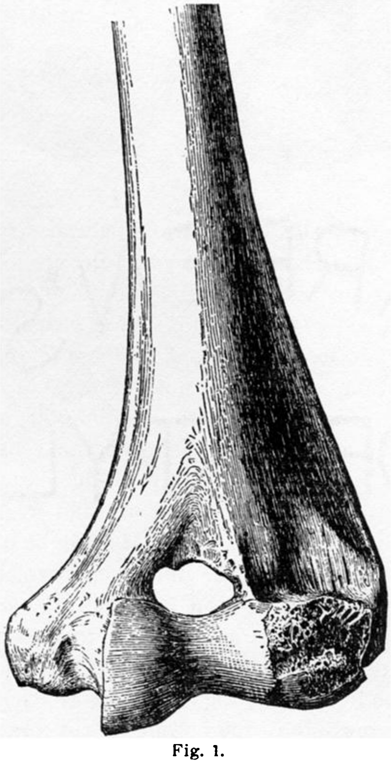

Fig. 1.

The accompanying figure 1, natural size, is of the lower part of a left humerus, from the Salado Valley (Hemenway) collection; it was made by Dr. J. C. McConnell, of the Army Medical Museum. The foramen is quite large, as are most of those in this collection.

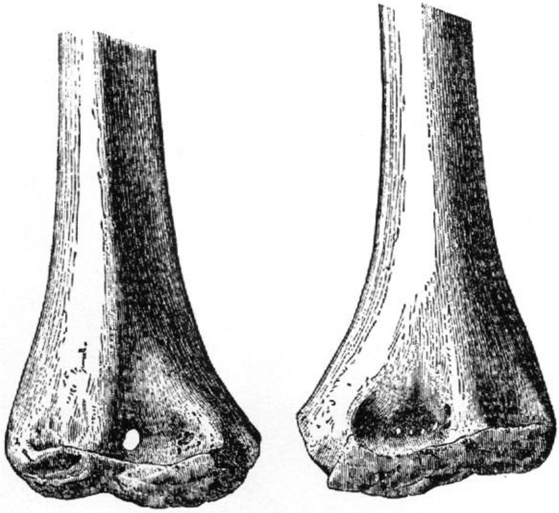

Fig. 2.

Figure 2 is also by Dr. McC. and of natural size. It represents the humeri of a child about eleven years old, from the same collection. The right humerus shows a small foramen, with sloping edges. The left shows a wider, flatter, and thinner partition, with several small openings. It looks to me as if these foramina were just in process of formation, with the promise of the left being the larger. I was at first inclined to think with De Blainville and Meckel that the foramen was due to a want of ossification; but if I interpret these specimens correctly it is formed at least sometimes and probably always, not by a failure to ossify, but by a process of atrophy after ossification has taken place. It will be observed that the fossæ and foramina are above the line of epiphyseal junction.

The fact that in the collection of tapirs above mentioned the young did not show the foramen while the mature animals did seems to favor my proposition that atrophy occurs as maturity approaches. If this be correct, then the atrophy itself would seem to be caused by the pressure of the coronoid or olecranon process, presumably the latter, as shown, for instance, in the dog, where in the dry bone the olecranon process projects even through the foramen.

Dr. Harrison Allen, of Philadelphia, wrote a commentary on this paper as it was originally prepared and before some important observations had been made. I insert here so much of his remarks as will apply to it in its present shape. He says:

"Reviewing the list in which the olecranon perforation is absent, it is seen that it includes all swimming and flying forms, as instanced in Sirenia, Cheiroptera, and Pinnepedia. In terrestrial types, which are adapted to life in the water, such as the aquatic carnivora, it is also absent. Such facts suggest the conclusion that the relief of the limb from impact is in some way associated with the absence of the foramen. In like manner the absence of the foramen in the Edentata is evidence in the same direction, since these creatures are either fossorial or arboreal, and in neither adaptation is any result of impact demonstrable in the limb. If, therefore, it be conceded that the foramen is absent as the result of withholding of co-ordinated lines of pressure which accompany progression upon the ground, it becomes interesting to contrast the humeri of the old and the new world monkeys. In those of the old-world group the foramen is present, since progression (except in *Hylobates*) is much the same as in other terrestrial mammals; whereas in those of the new world the prehensile tail must remove much of the impact from the limb.

"Again, even among the terrestrial carnivora the impact is much less (owing to the spread of the toes in the act of supporting the body) in Felidæ, Procyonidæ, and Ursidæ than in Canidæ. Why it is absent in some of the Ungulata and present in others is inexplicable by any such hypothesis. It appears to be variable in limbs of the same species as in the ourang and to be present in wild forms yet variable in domesticated forms of sus scrofa. In man the greater frequency of its presence on one side of the body is curious, for according to the law of impact it should be absent on both.

"In conclusion, I may say that the theory of impact appears to account for the presence of the foramen in some of the most highly differentiated forms, but that its significance is evidently complex and will not admit of a single explanation.

"In domesticated animals, including man, I am convinced that variations are always of obscure significance. The effects of diseased action often disturb the evolution of characters, and the observer must be on his guard how far to rely on general biological tenets in his attempts to explain variable structures."

Dr. J. L. Wortman, anatomist of the Army Medical Museum, has written the following opinion:

"The explanation of the presence or absence of the olecranon perforation in the mammalian humerus is not altogether an easy matter when we take into consideration the diverse and widely separated forms in which it occurs; still there can be little doubt that in some species at least, in which it is very constantly present, the simple mechanical explanation appears to be the only reasonable one that can be offered.

"An example of this kind is afforded by the dog and hyena, among the terrestrial carnivora. In them it will be noticed that the perforation or foramen is always large, and that the olecranon fossa is remarkable for its depth; that in extreme extension of the forearm the olecranon process of the ulna fits accurately into the foramen, thereby allowing the limb to assume nearly a straight line, which it could not otherwise do if no foramen were present. In the cat, on the other hand, in which the foramen is invariably absent, so far as my knowledge goes, the limb cannot be brought so nearly into a straight line by extreme extension of the forearm, for the reason that the olecranon process of the ulna impinges upon the bony septum between the coronoid and olecranon fossæ of the humerus.

"How, now, will we explain the difference in structure upon any hypothesis regarding the use of the limb? It is a fact to be constantly observed in the habits of these animals that the dog and hyena, in feeding, place both forelimbs upon the bone or other morsel and remove pieces by tearing or pulling them off with the mouth. Again, who has not noticed the delight of the puppy at play in taking hold of an object with his mouth and pulling? Both of these acts require that the forelimbs, in order to form an efficient brace, must be made to assume as nearly a straight line as possible, so that the strain may fall directly upon the bones and not depend upon the strength of the triceps muscle, which would prove a manifest disadvantage. A constant repetition of this posture and a constant effort upon the part of the animal to straighten out its forelimbs has caused an encroachment of the olecranon process upon the bony septum between the olecranon and coronoid fossæ, resulting, finally, in its disappearance and the formation of the foramen.

"In no other species of the carnivora, with the possible exception of the civets, do we observe similar habits or a similar use made of the forelimb; and in none of the rest of them do we find the foramen present. It may therefore be reasonably concluded, I believe, that in so far at least as these animals are concerned the mechanical hypothesis affords an explanation.

"As regards the presence of the perforation in other forms, Dr. Allen has already suggested a plausible reason for its absence in the Cebidæ and its frequent occurrence in the Simiidæ among the primates. Among the Rodentia it appears to be principally developed in the Lagomorphs or rabbits and the Hystricomorphs or porcupines and their allies, although some few of both the squirrel and rat divisions show it. I am not familiar with the habits of these animals; but it is possible that some peculiar movement of the forelimb in obtaining their food may be responsible for its production in a manner not dissimilar to that already discussed in regard to the dog and hyena.

"Concerning the Ungulates, its presence in such forms as the prong-horned antelope, the pig, peccary, tapir, and, possibly, a few others, would appear at first sight to be puzzling; but when we recall the habits of some of these species we are not so much at a loss for an explanation.

"The pig and peccary have a habit, similar to that of the dog, of using their forelimbs to hold their food firmly to the ground, if it is of so firm a nature as to require forcible tearing apart. The same conditions would prevail, therefore, as in the dog, and as a result the foramen appears. This explanation will not apply to the prong-horned antelope in so far as the particular use of the limb is concerned. In them I fancy the perforation appears by reason of their peculiarly stiff-legged way of running, if I may so call it. This is so marked that the practised eye of the hunter seldom fails to distinguish the peculiar gait of the animals even at a great distance, as I have so frequently observed. The effect is again the same in this case, namely, straightening the limb and the consequent pushing through of the olecranon process of the ulna.

"In the case of the tapir I am not sufficiently acquainted with the habits of the animal in its native haunts to offer any explanation, but it would not be at all surprising if it is found that he uses his forelimb after the manner of the pig in tearing up succulent roots and other materials upon which he feeds."

I have no further explanation of my own to offer and would rather submit the case in its present shape. The historical research seems to confirm the testimony of the osteological collections, that the foramen was most frequent among the ancient peoples. The relative habits will probably explain the difference.

The greater frequency on the left side is still an enigma. I have noticed that generally where it was present on both sides the left was usually the larger; where absent on both sides the left partition was usually thinner.

I desire to thank Dr. J. L. Wortman, anatomist of the Army Medical Museum, and Mr. Fred. Lucas, of the U. S. National Museum, for assistance in preparing this paper.

Bibliography.

1. Aeby, Chr., Der Bau des mensch. Körpers, Leipzig, 1871, p. 276.
2. d'Alton, E., Handbuch der mensch. Anat., Bd. I, Leipzig, 1850, p. 91.
3. Arnold, F., Handbuch der Anat., Freiburg, Bd. I, 1844, p. 473.
4. Cruveilhier, Anatomy, Translation, New York, 1844, p. 79.
5. Encyclopédie Anat., Paris, T. II, p. 135.
6. Fyfe, Anat., Edinburgh, 1819, Vol. I, p. 134.
7. Gray, Anat., Philadelphia, 1878, p. 227,
8. Handy, W. R., Anat., Philadelphia, 1854, p. 694.
9. Harrison, Robert, Anat., New York, 1860, p. 631.
10. Hartmann, Rob., Handbuch der Anat., Strassburg, 1881, p. 89.
11. Henle, Handbuch Anat., Braunschweig, Bd. I, 1867, p. 241.
12. Hoffmann, Schwalbe, Anat., Erlangen, 1877, Bd. I, p. 187.
13. Holden, Human Osteology, London, 1887, p. 236.
14. Hollstein, L., Anat., Berlin, 1865, p. 127.
15. Horner, Anat., Philadelphia, 1846, Vol. I, p. 219.
16. Humphry, Human Skeleton, London, 1858, p. 374, foot-note.
17. Hyrtl, Anat., Wien, 1889, p. 384.
18. Ledwich, Edward, Anat., Dublin, 1877, p. 32.
19. Leidy, Human Anat., Philadelphia, 1889, p. 166.
20. Meckel, Anat., Translation, Philadelphia, 1832, Vol. I, p. 472.
21. Monro, Anat., Edinburgh, 1813, Vol. I, p. 414.
22. Morel and Duval, Manuel d'anat., Paris, 1883, p. 92.
23. Oloriz, F., Anat., Zaragoza, 1886, T. I, p. 273.

24. Quain, Anat., London, 1867, Vol. I, p. 80.

25. Richardson, T. C., Anat., Philadelphia, 1867, p. 149.

26. Sappey, Anat., Paris, 1867, Vol. I, p. 372.

27. Todd, Encyclopedia, Vol. II, p. 66.

28. Meckel, Vergleich, Anat., Bd. II, Theil II, Halle, 1825, p. 361; also transl., Paris and Bruxelles, 1829, T. IV, p. 40.

29. Desmoulins, A., Hist. nat. des races humaines, Paris, 1826.

30. Bost. Med. & Surg. Jour., Vol. 66, 1862, p. 233.

31. Bull. Soc. Anthrop. de Paris, IV, 1863, pp. 510, 513, and 586.

32. Ditto, V, 1864, pp. 639 and 721.

33. Ditto, VI, 1865, pp. 83, 398, 466, 710.

34. Ditto, II, 2d sér., 1867, pp. 148, 159, 555, 690.

35. Ditto, IV, 1869, pp. 445 and 461.

36. Ditto, I, 3d sér., 1878, p. 433.

37. Ditto, IV, 1881, p. 392.

38. Second Internat. Congress of Anthropology, 1867, Paris, pp. 140 and 154.

39. Peabody Museum reports, 1868–1878; see Rev. d'anthrop., IX, 1880, p. 147.

40. Anal. Real. Acad. Sci., Habana, XIII, 1876–'7, pp. 267 and 281.

41. Topinard, Paul, Éléments d'anthrop. gén., Paris, 1885, p. 1015.

42. Philosoph. Trans., London, 1867, p. 299, St. George Mivart on "Append. skel. of primates."

43. Filhol, Trans. Geolog. Soc., Paris, 1881.

44. De Blainville, Osteographie, Paris, 1839 to 1864.

45. Cope, Report U. S. Geolog. Survey, Vol. III, part I, 1884.

46. Arens, J., Das Oberarmbein der Saügerthiere, Bonn, 1869, p. 19.

47. Kneeland, S., Jr., Jour. Boston Soc. Nat. Hist., June, 1852, p. 340.

48. Lund, Edward, Proc. Lit. and Philosoph. Soc., Manchester, IV, 1865, p. 57.

49. Hartmann, Dr. Robt., "Der Gorilla," Leipzig, 1880, p. 135.

The above paper was read before the Society February 15, 1890. In the discussion which followed, Dr. MATTHEWS said that as the olecranon perforation was, in all probability, due to repeated and forcible extension of the forearm, we must look for its cause in some labor which required its extension. Among the agricultural aborigines of the Southwest, who showed high percentages of this formation, we need not go far to discover the existence of such labor. The females were engaged during the greater part of their time in grinding corn; this was performed on a *metate*, or large flat stone, by means of a smaller stone, which was held in both hands of the operator and moved forward and backward. The chief exertion was made in moving the stone forward and required the most forcible extension of the forearm. Some agricultural tribes of the North used wooden mortars and pestles, which required a different motion in working them.

Professor COPE remarked that the orifice in the humerus discussed by Dr. Lamb could be called neither a foramen nor a fontanelle, but is simply a perforation dependent on the thickness of the lamina which separates the anterior and posterior fosssae of the humerus. It is not useful for systematic purposes, as its presence rarely coincides with the rest of the structure. It indicates a deficiency of bone structure at the locality in question, but he was unable to assign any definite cause for this condition. The presence of the perforation is certainly not due in some cases to continued extension of the fore-arms; since in many aquatic mammals, as the seals, where vigorous extension is necessary to the use of the limb in swimming, the foramen does not occur. Within a limited range the character might be useful for diagnostic purposes, as for instance, as an aid in discrimating certain races of mankind.

POLYNESIAN LANGUAGE.—René Allair (in Revue Géographique Internationale for December, 1889, p. 266) characterizes the language of Polynesia as follows:

"The language is soft; it is as clear and well defined as French, simple as English, but less unpleasant in pronunciation; poetical as German, but less complicated; rich as Russian, but less difficult. It abounds in vowels like Japanese and Italian; it is as noble as Spanish."

JOHN MURDOCH.